Specification

TITLE OF THE INVENTION

System for Transmission ~~of~~ ~~transmission~~ Digital Signals

The ~~The~~ *present* invention relates to a transmission system for

transmission of time-multiplex-channel-type digital signals

between a switching terminal device (exchange termination) and

a line termination.

DESCRIPTION OF THE RELATED ART

10   According to the terminology of the ITU-T G.960 standard

(3/93), "access digital section for ISDN basic rate access,"

in particular pages 2 and 3, the invention ~~thus~~ relates to a

data transmission at the V reference point. The data

transmission at the V reference point takes place according to

15   the ITU-T recommendation G.960, in particular page 2, Figure

1/G.960 and page 3, Figure 2/G.960 with associated

specification, and also Figures 5/G.960 and 6/G.960 on page 9,

with associated specification concerning functional elements

between state automata. In practical application, the

20   transmission takes place according to an industrial standard

used by several semiconductor manufacturers, called IOM®-2 as

an abbreviation of the expression "ISDN Oriented Modular

Interface." As can be seen in the company publication of the

semiconductor manufacturer Siemens, "ICs for Communications,

25   IOM®-2 Interface Reference Guide," in particular chapter 2,

"Global Picture," pages 6 to 12, as well as Figure 2 on page

8, time multiplex frames of 125 μm length are hereby

transmitted. Such a frame is partitioned into sub-frames,

called channels CH0, CH1, ..., which are respectively

30   allocated to a connection and thus form a connection frame.

In the described IOM®-2 interface standard, such a connection

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frame contains, again in time-division multiplex form, four
time-division multiplex channels, i.e., two useful channels B1
and B2, a monitor channel and a control information channel.
In the IOM®-2 standard, these channels are chronologically
arranged within the connection frame in such a way that the
control information channel is transmitted last. The
mentioned time-division multiplex channels each contain an 8-
bit word. Consequently, four 8-bit words are transmitted
quasi-simultaneously, i.e., within a connection frame cycle.

A transmission system for the transmission of digital signals
between an exchange termination and a line termination is
typically ~~standardly~~ part of a communication apparatus with a switching
device and with a subscriber terminal means, whereby the
switching device is coupled to the subscriber terminal means
via an exchange termination and via a line termination. Such
a communication apparatus serves to set up or, respectively,
dismantle narrow-band communication connections between
subscriber terminal means, and to enable a narrow-band
communication (speech, audio, narrow-band video, text,
facsimile, and/or data communication). Modern communication
devices ~~apparatuses~~ hereby make use of a digital transmission
technology, e.g. ISDN. In such communication *equipment* ~~apparatuses~~, it
is *necessary* ~~required~~ to connect the subscriber terminal units with the
switching devices via lines. This ~~standardly~~ takes place via
metallic line pairs. In a communication apparatus with many
subscriber terminal units, an extensively branched line
network is *therefore* ~~hereby~~ required.

If the service provided to a subscriber terminal unit by a
communication apparatus is to be moved from a location inside

the communication apparatus to another location, a
reconfiguration of the metallic connection lines between the
switching device and the subscriber terminal unit ~~is~~ *then*
~~standardly~~ required.

In many areas, nowadays a broadband communication apparatus,
e.g. a local data network LAN, is additionally installed
alongside a narrow-band communication apparatus. Such a local
data network can for example also be constructed in the form
of an emulated LAN on the basis of an ATM network. However,
an ATM network is often installed independent of the
construction of individual local data networks, in order to
connect several local data networks.

ATM hereby stands for asynchronous transfer mode. ATM
networks are described in (among other places) the book ATM
Networks, Rainer Händl, Manfred N. Huber, Stefan Schröder,
Edison Wessley Publishing Company, 2nd ed., 1994, in
particular in Chapter 4, pages 21 to 54. Within an ATM
network, data, packed into ATM cells, are transmitted in a
continuous ~~in~~ ATM cell stream ~~[sic]~~ via virtual channels of
virtual paths. The transmission takes place in connection-
oriented fashion. Subscribers can be connected via user
interfaces, known as UNI (user-network interface), determined
unambiguously by means of an identifier of the virtual path
VPI (Virtual Path Identifier) and by an identifier VCI of the
virtual channel (Virtual Channel Identifier).

One ~~The~~ object of the present invention is to *provide* ~~indicate~~ a
transmission system that enables, with an ATM network, the

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realization of a narrow-band communication system that is simple to install and simple to configure.

The invention achieves this object by means of a transmission system having the features of patent claim 1. Advantageous constructions are the subject matter of subclaims.

According to the *present* invention, a transmission system is *provided* ~~indicated~~ for the transmission of digital signals, present in the form of time-division multiplex channels, between an exchange termination and a line termination, ~~in which~~ a means for connection to a user interface of an ATM network is respectively provided both for the exchange termination and for the line termination. *The mechanism converts* ~~said means serving for the conversion~~ of the time-division multiplex data into ATM cells or, respectively, *performs* the conversion of the ATM cells into time-division multiplex data. Such a transmission system contributes to the solution of the object named above in that a virtual ATM channel is allocated to each time-division multiplex channel.

In this system ~~It is thereby enabled~~ that the time-division multiplex data of the individual time-division multiplex channels can be inserted into an ATM cell stream, and ~~that~~ the cell stream can be distributed within the ATM network using administrative measures -- namely, unambiguous allocation of a VPI address/VCI address of the ATM network to a time-division multiplex channel. Modifications of the distribution within the ATM network are very easily *achieved* ~~possible~~ by this means, since, given for example a relocation of a subscriber from the region of a user interface of the ATM network into the region of

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another user interface of the ATM network, only the allocation of the VPI address/VCI address has to be changed. Moreover, by means of a transmission system as specified the problem of a physically caused range limitation between a switching

5   device and a terminal apparatus is removed in a communication apparatus, since the user interface can be brought to a subscriber terminal unit or, ~~respectively~~ to a switching device as needed.

10   If an ATM network is already present in a region in which a narrow-band communication apparatus is to be installed, the large-scale distribution of the information of the narrow-band communication can take place via the ATM network, and the distance between the network termination and the line

15   termination can respectively be very small. If the ATM network for example offers the possibility of a connection between user interfaces that are arranged at a great distance from one another, subscriber terminal means that are correspondingly removed from one another can also be connected

20   to a narrow-band switching apparatus. For example, by modification of the address allocations in the ATM network, calls coming into extensively branched company networks can be routed as needed (e.g., dependent on the time of day) to different terminal apparatuses, or line groups located at a

25   distance from one another.

A development of the inventive transmission system is formed by a communication apparatus with a switching device for time-division multiplex digital signals, and having several

30   exchange terminations. Several exchange terminations are hereby preferably connected to a single user interface of an

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ATM network. Dependent on the number of exchange terminations and the bandwidth provided by the user interface, at best all exchange terminations of the switching device can be connected to a single user interface of the ATM network.

A means for converting time-division multiplexing data and ATM cells preferably contains a channel multiplexer/demultiplexer for distributing the digital signals of the individual time-division multiplex channels to the respectively allocated ATM cells or, respectively, for the recuperation of the digital signals from the ATM cells and distribution into the allocated time-division multiplexing channels. Moreover, such a means provides an ATM converter for packing items of digital information obtained from the channel multiplexer/demultiplexer into ATM cells or, respectively, for unpacking ATM cells and giving the items of digital information contained therein to the channel multiplexer/demultiplexer, as well as for inserting ATM cells into a cell stream of the ATM network or, respectively, for removing ATM cells from this cell stream. In addition, a corresponding converter means preferably contains an interface, e.g. an STM1 interface, in order to pass an item of synchronization information of the time-division multiplex signals to the ATM network, or, respectively, to receive such information from the ATM network, evaluate it, and pass it to the ATM converter and to the channel multiplexer/demultiplexer.

A transmission system as described above ensures that items of information concerning the line status between a line termination and the allocated network terminal of a subscriber

terminal means are transmitted to the exchange termination via the V reference point in the context of the standard time-division multiplex signaling. Moreover, the described construction of the conversion means ensures that the time-division multiplex signals are synchronized in the region of the subscriber terminal unit and in the region of the switching device.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is explained in more detail, with reference to the figures, wherein

Fig. 1 is a block diagram, illustrating an embodiment of an inventive transmission system;

Fig. 2 is a block diagram, illustrating a communication apparatus as an example of the application of an inventive transmission system; and

Fig. 3 illustrates a transmission path between the subscriber terminal equipment and exchange termination according to ITU-T G.960, including an inventive transmission system in the region of the V_1 reference point.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 is a block switching diagram of an inventive transmission system with an exchange termination ET and a line termination LT, respectively connected to a user interface UNI of an ATM network ATMN via a means IWF for converting time-division multiplex data and ATM cell data. The exchange termination ET shown contains a line driver circuit (line card) LINE-C, which for example provides an IOM®-2 interface to

the line termination. The line termination LT contains an ISDN interface ISDN-IF, which provides a corresponding IOM®-2 interface to the exchange termination ET. The two converter means IWF shown respectively serve for the conversion of time-division multiplex data into ATM cell data, as well as of ATM cell data into time-division multiplex data, and respectively contain a channel multiplexer/demultiplexer C-M/DM, in order to distribute the digital signals of the individual time-division multiplex channels to the respectively allocated ATM cells, or, respectively, to recuperate them from the ATM cells and distribute them into the allocated time-division multiplex channels. Moreover, these means IWF respectively contain an ATM converter ATMC for packing items of digital information received from the channel multiplexer/demultiplexer C-M/DM in ATM cells or, respectively, for unpacking information from ATM cells and giving it to the channel multiplexer/demultiplexer C-M/DM, and for the insertion of ATM cells into a cell stream of the ATM network ATMN, via the respective user interface UNI, and for removing ATM cells from a cell stream of the ATM network ATMN. In addition, an interface IF-STM1 is contained in each means IWF, in order to pass an item of synchronization information of the time-division multiplex signals to the ATM network ATMN, or, respectively, to receive it from the ATM network ATMN, evaluate it, and pass it to the ATM converter ATMC and to the channel multiplexer/demultiplexer C-M-DM.

The design of the ATM network is ~~inessential for the~~ *Known by those of ordinary skill in the art* ~~invention,~~ and thus is not explained in detail here.

The means IFW for converting time-division multiplex data and ATM cells can be realized both as an independent means between

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the line termination LT and the allocated user interface UNI
of the ATM network ATMN, and also as an input arrangement of
the user interface UNI or as an output arrangement of the line
termination LT. Correspondingly, it can also be realized as
an output arrangement of an exchange termination ET, or as an
intermediately connected arrangement.

Fig. 2 shows an inventive transmission system with a switching
device PBX for setting up and dismantling narrow-band
connections between communication terminal apparatuses (not
shown), which can be connected via subscriber terminal means S_0
in the exemplary embodiment shown. The switching device PBX
contains at least one exchange termination ET that is
connected with a user interface UNI of the ATM network ATMN,
likewise shown, via a means IWF for converting time-division
multiplex data and ATM cell data. Among other things, the ATM
network ATMN contains a switching node ATM-hub, and several
ATM add/drop multiplexers ATM-DMX, to which user interfaces
UNI, as well as other networks, such as e.g. local networks
LAN or public narrow-band communication networks ISTN, can be
connected, as is shown in Fig. 2. If, in the ATM network ATMN
shown in Fig. 2, user interfaces UNI are represented as
immediately following the switching nodes ATM-hub or,
respectively, the ATM add/drop multiplexer ATM-DMX, this has
no effect on the actual form of the realization of the ATM
network, but rather merely illustrates the arrangement of the
individual elements in relation to an information flow.

The subscriber terminal devices S_0 shown in Fig. 2 are
respectively coupled to the user interfaces UNI via a line

termination LT and a means IWF for converting time-division
multiplex data and ATM cell data.

As can be seen from Fig. 2, a transmission system according to
the invention enables a simple realization of a narrow-band
communication apparatus, in which the installation of terminal
lines is required only between user interfaces UNI of the ATM
network ATMN and subscriber terminal units S_0, or,
respectively, between the switching device PBX and a user
interface UNI of the ATM network ATMN.

In Fig. 2, only one exchange termination ET, which is
connected with a user interface UNI of the ATM network ATMN,
is shown in the switching device PBX. Of course, for each
line segment LT to be connected, and for trunk connections to
global communication networks ISTN, an exchange termination ET
can respectively be provided, which is connected to a user
interface UNI of the ATM network ATMN via a separate user
interface UNI, or is so connected in common with other
exchange terminations ET.

As can be seen from the structure shown in Fig. 2, the
allocation of individual exchange terminations ET and line
terminations LT can be determined by the ATM network ATMN, so
that a reconfiguration of individual line terminations LT is
possible by means of simple administrative measures.

Fig. 3 shows a variant of the representation designated Fig.
1/G.960 in the above-mentioned standard ITU-T G.960, which
variant connects a subscriber terminal apparatus TE (terminal
equipment) to a network termination NT1 via a reference point

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This design the

T couples ~~this~~ network terminal NT1 to a line termination LT
via a digital transmission path ~~(not shown in more detail)~~,
and connects this line termination LT to an exchange
termination ET via a reference point V_1. In Fig. 3, in

5   addition to the figure shown in ITU-T G.960, an inventive
realization of the reference point V_1 with an ATM network ATMN
with user interfaces UNI is shown, as well as with means IWF
for connecting the line termination LT and the exchange
termination ET to the ATM network ATMN, in order to convert

10   the time-division multiplex data and the ATM cell data.